CLAIMS

We claim:

1. A method of forming a heat spreader ball grid array package, comprising the steps:

providing a semiconductor chip affixed to a ball grid substrate;

encasing the semiconductor chip over the ball grid substrate with a molding compound;

mounting a heat spreader over the ball grid substrate and spaced apart from the molding compound to form a gap; and

placing thermal grease into the gap at least between the heat spreader and the molding compound to form the heat spreader ball grid array package.

2. The method of claim 1, wherein the semiconductor chip is a silicon semiconductor chip, a germanium semiconductor chip or a silicon germanium semiconductor chip..

3. The method of claim 1, wherein the molding compound is comprised of epoxy resin and a curing agent; and the heat spreader is comprised of copper, aluminum, chromium plated on copper, chromium plated on aluminum, nickel plated on copper or nickel plated on aluminum.

4. The method of claim 1, wherein the molding compound is comprised of epoxy resin; and the heat spreader is comprised of copper.

5. The method of claim 1, wherein the thermal grease is comprised of silicon rubber containing heat-conducting particles.

6. The method of claim 1, wherein the heat-conducting particles comprises zinc oxide, aluminum oxide, aluminum nitride, boron nitride or ceramic fillers.

7. The method of claim 1, wherein the thermal grease is comprised of epoxy resin, curing agent, a catalyst, a coupling agent, a filler, a flame retardant, a mold-release agent, a coloring agent and a stress-relief agent.

8. The method of claim 1, wherein the molding compound has a coefficient of thermal expansion of from about 5 to 15; and the heat spreader has a coefficient of thermal expansion of from about 10 to 25.

9. The method of claim 1, wherein the molding compound has a coefficient of thermal expansion of about 7.0; and the heat spreader has a coefficient of thermal expansion of about 17.0.

10. The method of claim 1, including forming a pillar onto the ball grid substrate outboard of the semiconductor chip and the molding compound; wherein the heat spreader is mounted to the pillar.

11. The method of claim 1, including forming a pillar onto the ball grid substrate outboard of the semiconductor chip and the molding compound; the pillar including a stiffener portion; wherein the heat spreader is mounted to the pillar.

12. The method of claim 1, including forming a pillar onto the ball grid substrate outboard of the semiconductor chip and the molding compound; the pillar including a copper stiffener portion; wherein the heat spreader is mounted to the pillar.

13. A method of forming a heat spreader ball grid array package, comprising the steps:

providing a semiconductor chip affixed to a ball grid substrate;

encasing the semiconductor chip over the ball grid substrate with a molding compound;

placing thermal grease over the semiconductor chip;

mounting a heat spreader over the ball grid substrate and thermal grease to form the heat spreader ball grid array package; and

mounting the heat spreader to a PCB substrate or stiffener using adhesive.

14. The method of claim 13, wherein the semiconductor chip is a silicon semiconductor chip, a germanium semiconductor chip or a silicon germanium semiconductor chip..

15. The method of claim 13, wherein the molding compound is comprised of epoxy resin and a curing agent; and the heat spreader is comprised of copper, aluminum, chromium plated on copper, chromium plated on aluminum, nickel plated on copper or nickel plated on aluminum.

16. The method of claim 13, wherein the molding compound is comprised of epoxy resin; and the heat spreader is comprised of copper.

17. The method of claim 13, wherein the thermal grease is comprised of silicon rubber containing heat-conducting particles.

18. The method of claim 13, wherein the heat-conducting particles comprises zinc oxide, aluminum oxide, aluminum nitride, boron nitride or ceramic fillers.

19. The method of claim 13, wherein the thermal grease is comprised of epoxy resin, curing agent, a catalyst, a coupling agent, a filler, a flame retardant, a mold-release agent, a coloring agent and a stress-relief agent.

20. The method of claim 13, wherein the molding compound has a coefficient of thermal expansion of from about 5 to 15; and the heat spreader has a coefficient of thermal expansion of from about 10 to 25.

21. The method of claim 13, wherein the molding compound has a coefficient of thermal expansion of about 7.0; and the heat spreader has a coefficient of thermal expansion of about 17.0.

22. The method of claim 13, including forming a pillar onto the ball grid substrate outboard of the semiconductor chip and the molding compound; wherein the heat spreader is mounted to the pillar.

23. The method of claim 13, including forming a pillar onto the ball grid substrate outboard of the semiconductor chip and the molding compound; the pillar including a stiffener portion; wherein the heat spreader is mounted to the pillar.

24. The method of claim 13, including forming a pillar onto the ball grid substrate outboard of the semiconductor chip and the molding compound; the pillar including a copper stiffener portion; wherein the heat spreader is mounted to the pillar.

25. A heat spreader ball grid array package, comprising:

a ball grid substrate;

a semiconductor chip affixed to the ball grid substrate;

a molding compound encasing the semiconductor chip over the ball grid substrate;

a heat spreader mounted over the ball grid substrate and spaced apart from the molding compound to form a gap; and

thermal grease within the gap at least between the heat spreader and the molding compound.

26. The structure of claim 25, wherein the semiconductor chip is a silicon semiconductor chip, a germanium semiconductor chip or a silicon germanium semiconductor chip.

27. The structure of claim 25, wherein the molding compound is comprised of epoxy resin and a curing agent; and the heat spreader is comprised of copper, aluminum, chromium plated on copper, chromium plated on aluminum, nickel plated on copper or nickel plated on aluminum.

28. The structure of claim 25, wherein the molding compound is comprised of epoxy resin; and the heat spreader is comprised of copper.

29. The structure of claim 25, wherein the thermal grease is comprised of silicon rubber containing heat-conducting particles such as zinc oxide, aluminum oxide, aluminum nitride, boron nitride or ceramic fillers or other materials which have the properties of heat conduction.

30. The structure of claim 25, wherein the thermal grease is comprised of epoxy resin, curing agent, a catalyst, a coupling agent, a filler, a flame retardant, a mold-release agent, a coloring agent and a stress-relief agent.

31. The structure of claim 25, wherein the thermal grease is comprised of epoxy resin, curing agent, a catalyst and a coupling agent.

32. The structure of claim 25, wherein the molding compound has a coefficient of thermal expansion of from about 5 to 15; and the heat spreader has a coefficient of thermal expansion of from about 10 to 25.

33. The structure of claim 25, wherein the molding compound has a coefficient of thermal expansion of about 7.0; and the heat spreader has a coefficient of thermal expansion of about 17.0.

34. The structure of claim 25, wherein the semiconductor chip is a silicon semiconductor chip and has a coefficient of thermal expansion of from about 2.5 to 3.5.

35. The structure of claim 25, wherein the heat spreader has a shape of an inverted square pie tin having an elongated surrounding lip.

36. The structure of claim 25, wherein the heat spreader has a shape of an inverted square pie tin having elongated surrounding lip; the heat spreader being mounted onto the ball grid substrate at the elongated surrounding lip using epoxy adhesive.

37. The structure of claim 25, wherein the heat spreader has a shape of an inverted square pie tin having an elongated surrounding lip; and wherein the thermal grease nearly fills the gap.

38. The structure of claim 25, further including a pillar formed onto the ball grid substrate outboard of the semiconductor chip and the molding compound; wherein the heat spreader is mounted to the pillar.

39. The structure of claim 25, further including a pillar formed onto the ball grid substrate outboard of the semiconductor chip and the molding compound; the pillar including a stiffener portion; wherein the heat spreader is mounted to the pillar.

40. The structure of claim 25, further including a pillar formed onto the ball grid substrate outboard of the semiconductor chip and the molding compound; the pillar including a copper stiffener portion; wherein the heat spreader is mounted to the pillar.

41. A heat spreader ball grid array package, comprising:

a ball grid substrate;

a semiconductor chip affixed to the ball grid substrate;

a molding compound encasing the semiconductor chip over the ball grid substrate;

thermal grease over the molding compound;

a heat spreader mounted over the ball grid substrate, the molding compound and the thermal grease; and

a PCB substrate or a stiffener mounted to the heat spreader.

42. The structure of claim 41, wherein the semiconductor chip is a silicon semiconductor chip, a germanium semiconductor chip or a silicon germanium semiconductor chip.

43. The structure of claim 41, wherein the molding compound is comprised of epoxy resin and a curing agent; and the heat spreader is comprised of copper, aluminum, chromium plated on copper, chromium plated on aluminum, nickel plated on copper or nickel plated on aluminum.

44. The structure of claim 41, wherein the molding compound is comprised of epoxy resin; and the heat spreader is comprised of copper.

45. The structure of claim 41, wherein the thermal grease is comprised of silicon rubber containing heat-conducting particles such as zinc oxide, aluminum oxide, aluminum nitride, boron nitride or ceramic fillers or other materials which have the properties of heat conduction.

46. The structure of claim 41, wherein the thermal grease is comprised of epoxy resin, curing agent, a catalyst, a coupling agent, a filler, a flame retardant, a mold-release agent, a coloring agent and a stress-relief agent.

47. The structure of claim 41, wherein the thermal grease is comprised of epoxy resin, curing agent, a catalyst and a coupling agent.

48. The structure of claim 41, wherein the molding compound has a coefficient of thermal expansion of from about 5 to 15; and the heat spreader has a coefficient of thermal expansion of from about 10 to 25.

49. The structure of claim 41, wherein the molding compound has a coefficient of thermal expansion of about 7.0; and the heat spreader has a coefficient of thermal expansion of about 17.0.

50. The structure of claim 41, wherein the semiconductor chip is a silicon semiconductor chip and has a coefficient of thermal expansion of from about 2.5 to 3.5.

51. The structure of claim 41, wherein the heat spreader has a shape of an inverted square pie tin having an elongated surrounding lip.

52. The structure of claim 41, wherein the heat spreader has a shape of an inverted square pie tin having elongated surrounding lip; the heat spreader being mounted onto the ball grid substrate at the elongated surrounding lip using epoxy adhesive.

53. The structure of claim 41, wherein the heat spreader has a shape of an inverted square pie tin having an elongated surrounding lip; and wherein the thermal grease nearly fills the distance between the molding compound and the heat spreader.

54. The structure of claim 41, further including a pillar formed onto the ball grid substrate outboard of the semiconductor chip and the molding compound; wherein the heat spreader is mounted to the pillar.

55. The structure of claim 41, further including a pillar formed onto the ball grid substrate outboard of the semiconductor chip and the molding compound; the pillar including a stiffener portion; wherein the heat spreader is mounted to the pillar.

56. The structure of claim 41, further including a pillar formed onto the ball grid substrate outboard of the semiconductor chip and the molding compound; the pillar including a copper stiffener portion; wherein the heat spreader is mounted to the pillar.